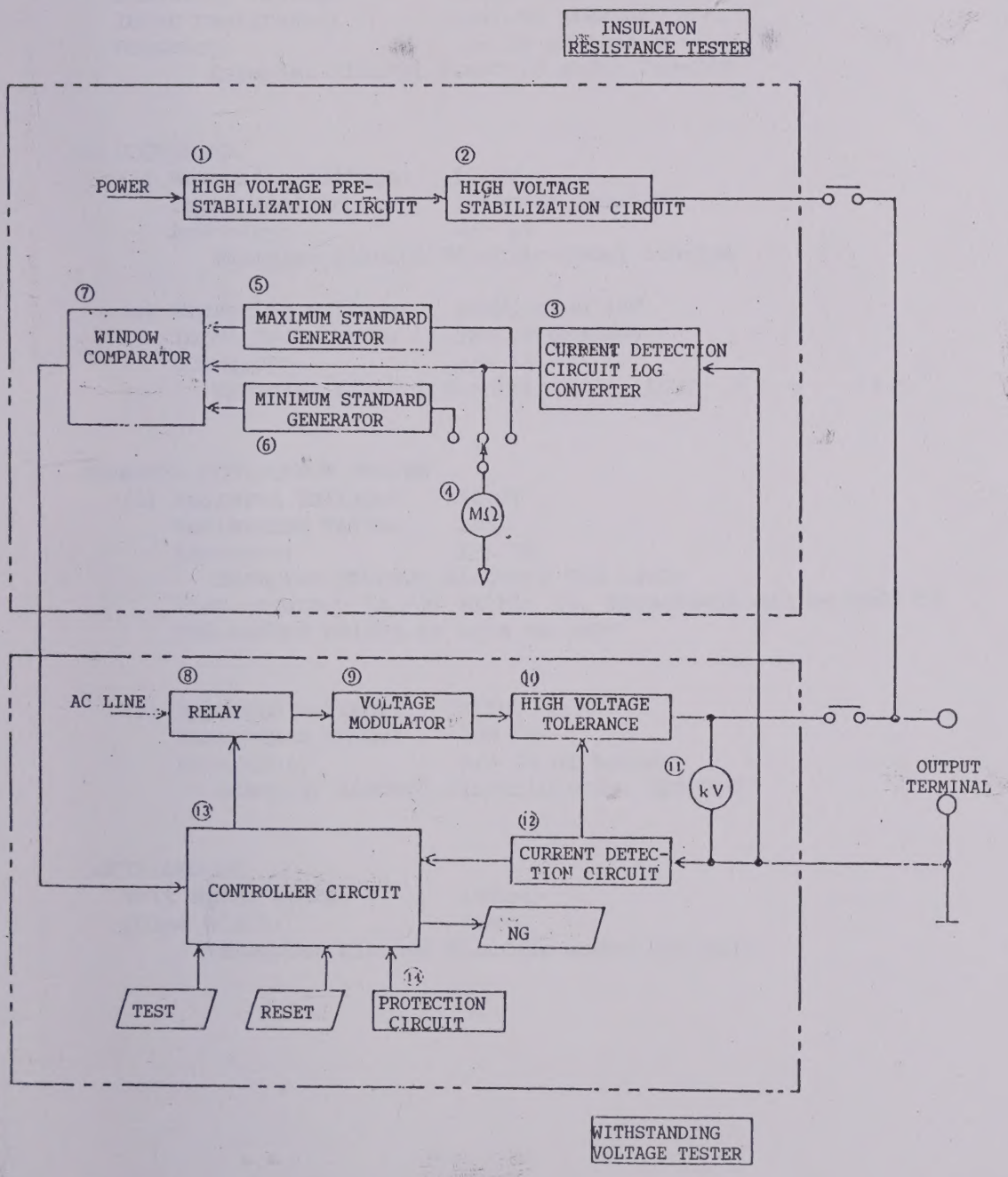
Kikusui

MODEL 871

SERVICE MANUAL

received
Jun. 12. '89

BLOCK DIAGRAM



REQUIRED MEASURING EQUIPMENT

AC VOLTMETER

Measuring voltage: 2.5kv, 5kv
Input resistance: 20MΩ or greater
Accuracy: +/- 1% or better
Example: Kikusui Electric model 149-10A

DC VOLTMETER

(1) Measuring voltage: 1100V
Input resistance: 1000MΩ or greater
Accuracy: +/- 1%
Example: Kikusui Electric model 149-10A

(2) Measuring voltage: 10mV, also 10V
Input Resistance: 1MΩ or greater
Accuracy: +/- 1%
Example: Kikusui Electric model 1506 Fluk. 8840

STANDARD RESISTANCE TESTER

(1) Approved Voltage: 1100V
Resistance Value: 100K
Accuracy: +/- 1%
Example: Kikusui Electric TOS 1200
When accuracy is not within 1%, adjustment can be made by the method writen in note on page

(2) Approved voltage: 1100V
Resistance Value: 10MΩ
Accuracy: +/- 1% or better
Example: Kikusui Electric model 929-10M

OSCILLOSCOPE

Volt Swing Width: 15Vp-p
Pulse Width: 50ms
Example: Kikusui Electric model COS 5020

CURRENT COMPARATOR

Withstanding Voltage Test (Cut-Off Current Judgement, PCB A6)

(1) Current Detection

When the setting for the cut-off current is below 10mA, detection is carried out by R668 and R669. When the setting is 11mA or greater, R670 and R671 are connected parallely. The detected voltage is wave rectified on 1/2 of ICs U612 and U611 and is a direct current.

This voltage is output to Signal Out thru 1/2 of U611.

(2) Judgement

At the point of current detection, voltage going to direct current is compared to the set maximum value and to 1/10 of the minimum value, at U610. When the maximum value is exceeded, voltage is sent to substrate A1 as a U/NG signal. When the minimum value is not reached, voltage is sent to substrate A1 as a L/NG signal. Maximum value REF (TP2) and minimum value REF are divided at R690 and R691.

(3) Maximum Set Value (Cut-Off Current)

The voltage corresponding to the maximum set value is output to TP1. The basic voltage created at 1/2 of U607 is amplified at 1/2 of U608 and U607 and is TP1 of voltage. The rate of amplification changes depending on the selection from R645 to R654.

Thru the set Cut-Off Current signal and Current Set signals, ICs U602 thru U604 are selected, and transistors Q2101 thru Q209 become drive signals. These are selected by Current Set R/L signals.

Voltage of TP1 is amplified at U609 and output at TP2. This becomes the standard value REF for comparison of currents. Amplitude ratio at U609 is 1 when cut-off current is less than 10mA and increases 10 times when Cut-Off Current is greater than 11mA, by turning transistor Q210 on.

At 10mA or below, R654 is for compensation.

INSULATION RESISTANCE TESTER

(1) Current Detection

Current for the device being tested flows thru resistor R225 to transistor Q204. Voltage proportionate to the logarithm of the current using the characteristics of IB and VBE of Q209 appear at pin 6 of IC U205. It is not possible to set the resistance of the tested device at 0Ω or ∞ on the scale using logarithms. However the needle does move from 0 to ∞ , and maximum should be calibrated at 0Ω.

For ∞, logarithmic output, when current is flowing to the tested device, at 0, should be 0V.

Oscillation at 0Ω, restricts the testing current and the maximum current output and logarithmic output voltage is exactly 0V.

Logarithmic output voltage passes thru buffer IC U214 and Buffer IC U207 to the comparator and to the meter, and outputs to Signal Out connector.

(2) Comparator

Compare the minimum standard value at IC U208 and the maximum standard value at IC U209. The compared output passes thru IC U210 and I/NG signal is sent to substrate A1.

(3) Maximum and Minimum Judgement Values

Set minimum at RV501 of PCB A5 and maximum at RV502. At IC U212 the external standard voltage from I Tester Connector switches over to the setting of the unit.

TEST (SUBSTRATE A1)

(1) At IC U103 the signal from the test button on the panel and the signal from Test Only Connector is selected and the test signal input to FF IC U104 is recorded. Selection is performed by the R/L signal from the connector.

The signal output from U104 and the TFF(0) signal from the W/I/R controller is switched over at IC U106, and TFF(0) signal turns on.

TFF(0) signal and Stand-By signal from Test Adapter B Connector is switched over by Test Adaptor signal from Test Adapter A and becomes a Stand-By signal.

The Stand-By signal and W/I Start signal from W/I/R Controller Connector are converted at IC U106. The L/R signal from W/I/R Controller at Low Level and the W/I Start Signal can be selected.

W Test signal from Function Connector and I Test signal are recorded to FF IC U110. One of the signals (both signals cannot exist at the same time) or W/I Start signals selected at IC U117. R/L signal of Function Connector at High Level and W/I Start signal can be selected.

The selected signal at IC U117 is recorded at FF IC U118 and becomes a T On signal. When Function switch is set to Auto Test the type of test (W Test or I Test) Reset signal, at High Level, is recorded onto 1/2 of FF IC U114. High Level is when Reset button is pushed or when Power is turned on.

When the test mode (W Test, I Test) is completed, Timer signal is input. FF turns over and the test mode changes.

When function test is set at Auto Test, the setting of either W Test or I Test is selected by IC U116. Depending on the setting of the function switch, the type of test and W or I Test signal from Function Connector is selected by IC U117.

When T On signal is present, transfer of signal selected by IC U117 to IC U119 is delayed and each I Drive, Z Drive and W Drive signal turns on.

For Insulation Resistance Test, the I Drive signal appears and Relay K-HI and K5 are executed and I Timer begins.

For Withstanding Voltage test, K-HW Relay is executed thru W Drive Signal. Z Drive signal executes Zero Turn On switch and SW, K-HW relays.

PROTECTION

High Level is in "Protection State" when Protection signal is at "P" line FF (flip flop, hereafter referred to as FF). The Set output of IC U123 becomes the Protection signal.

The Protection signal performs the following functions:

(1) It passes thru the buffer IC U120 and becomes LED P signal, causing Protection LED to turn on.

(2) (P) U (NG) signal is output to the function connector on the back of the unit.

(3) As FF Reset signal, it resets T On FF IC U118 and cancels the test condition.

(4) Resets W/NG or I/NG FF IC and cancels W/NG or I/NG condition.

(5) Becomes a reset signal and reset Timer mode FF IC U114 and thru 1/2 of FF IC U114, begins auto mode (which is set by the function switch).

Protection signal is activated by the following conditions:

(1) When Function Switch is Used.
A change of the Function switch is detected by IC U109 and U113, and uses U112 and 122 to do so.

(2) When Range of Withstanding Voltage Tester is Changed.
Protection signal turns on using IC U129, U126, and U128 when 2.5 KV (from range changing switch on unit) signal is manual (L/R voltage is local).

(3) When I Test Voltage 100V/500 is Changed.
When setting of I Test voltage becomes a 1000V signal, Protection signal turns on thru IC U128.

(4) When Setting of I Test Voltage is Changed Between Remote and Local.
Thru IC U211 (substrate A2) 500/1000 R/L signal from I Tester Connector becomes a 1000V/500V remote signal and Protection signal turns on thru U128 (A PCB).

(5) When Using W/I/R Controller and Connection Between W/I/R Test Connector and Other Device is Cut-Off.
L/R signal from W/I/R Controller passes thru IC U101 (substrate A1) and becomes Int/Ext L/R signal, then passes thru IC U121 and IC U122, causing Protection signal to turn on.

(6) When Using Remote Control Box, and Connection Between W/I Test Only Connector and Other Device is Cut-Off.
Test reset R/L signal from W/I Test Only Connector passes thru U101 (PCB A1) and Protecton signal turns on, as in item 5 written above.

(7) When Only Test Adaptor B is Connected.
Test Adaptor B has no Protection signal, thru IC U101 no signal at Test Adaptor A is detected and T Adap P signal turns on. Signal is recorded at FF IC U123 thru IC U122 and Protection signal P turns on.

(8) When Using Test Adaptor, an Abnormal Signal is Output.
Protection signal from Test Adapter turns Protection signal P on in the same way as written in above item 7.

(9) When Digital Switch of Leak Current (mA) is Set at 20mA or Below and Connection to Output Voltage Remote Controller Turns On and Off.
L/R signal from voltage remote controller connector enters IC U126 using IC U128 and Protection signal P turns on.

(10) When Using with Output Voltage Remote Controller and Set Value of Leak Current (mA) of Digital Switch has Changed from Below 20mA to 21mA or Greater, or When There is a Change in the Direction.
The 21mA signal, thru IC U127 and IC U126, in the same way as item 9 written above, turns Protection signal P on.

(11) When Used with Output Voltage Remote Controller and a Protection Signal Occurs at the Controller.
A P signal from the voltage remote controller turns Protection signal P on.

(12) When the Setting of the Leak Current Standard Value Changes from Panel Operation to Remote Setting, or Direction Changes.
C, L/R signal of PCB A6 (comparator of voltage withstanding test, etc.), thru IC U121, U122 of PCB A1, is recorded to FF IC U123 and Protection signal P turns on.

(13) When Connection Between the Function Connector and the Other Device Turns On and Off.
R/L signal from Function Connector, thru IC U112, U121 and U122 is recorded to FF IC U123 and Protection signal P turns on.

(14) When Withstanding Voltage Test and Insulation Resistance Test are Executed at the Same Time.
Protection signal P is output if input area of 1/4 of IC U108 evaluates that W Drive signal and I Drive signal are output at the same time.

RESET

Reset signal of Reset button (on unit), connector and power on thru IC U105 and U107 turn Reset signal on. When Reset signal becomes RESET signal, FF for maintaining the state of each part of the test, is reset.

NG

NG of Insulation Resistance Test

When Insulation Resistance Test is no good, I/NG signal is output from the comparator. When I Drive signal from executing insulation resistance test is output, IC U119 determines I/NG signal and records it at FF IC U123. Output of IC U123, as the I/NG signal, turns on I/NG LED thru IC U132. Moreover, as K I/NG signal (PCB A3), K I/NG relay is activated and I/NG signal is outpout to Signal Out Connector. Also, the K I/NG signal is suplied to the buzzer.

NG of Withstanding Voltage Test

When Withstanding Voltage Test is no good, L/NG or U/NG signal is output from the comparator. When the Z signal which controls the Zero Cross Switch of the Withstanding Voltage Test is output, the output signal - L/NG or U/NG - is determined by IC U115 and is recorded at FF IC U123. Output of IC U123 serves as the W/NG signal, and turns on W/NG LED thru U132. Moreover, as W/NG signal (PCB A3), K W/NG relay is activated and W/NG signal is outpout to Signal Out Connector. Also, the K W/NG signal is supplied to the buzzer.

GOOD

As the time on the timer expires, operations complete and, in the case of Withstanding Voltage Test, W signal is generated. In the case of the Insulation Resistance Test, I signal is generated. When one of the signals is present, Timer signal turns on and is output to Function Connector as Timer signal.

Thru IC U117, Timer Signal, when Timer On/Off switch is on, is recorded at FF IC U123 and Good signal turns on. After 50 ms, FF IC U123 is reset, and Good signal turns off. The above also pertains to independant testing of Withstanding Voltage Test and Insulation Resistance Test.

When automatic testing is done, the first Timer Cycle completes and is recorded at FF IC U114, and lags behind R145 and C141, then is passed to IC U115 and enters IC U116.

When there is a Timer Signal, IC U115 outputs an output signal, however, R145 and R141, in order to cause a delayed Timer Signal, turn off before IC U115 outputs at the first Timer Signal.

When the second Timer Signal is generated, the former effect is erased, and operation is the same as testing independantly.

Good Signal turns on the Good LED thru U132. Moreover, as K Good Signal (PCB A3), Good Signal moves and is output to Signal Out Connector. The Good Signal is supplied to the buzzer. Also, it passes thru IC 107 and Reset Signal turns on.

TROUBLE SHOOTING

For trouble shooting, trouble points are shown in order of discovery. For conditions not stated here, please refer to the circuit explanations and block diagrams.

(1) LEDs Do Not Turn On

The 0.5A Slow Blow fuse is out or a small transformer is disconnected. For fuse location, refer to page 11. If the fuse blows again soon after replacing it, check the diode and capacitor.

(2) Protecton Lamp Does Not Turn Off When Reset is Pressed

1. Refer to the conditions listed separately in the Protection Operation Manual. Check if any of the conditions are not met.

2. Reset Signal is not present. Check Reset signal of IC U123 (PCB A1.)

3. Protection Circuit is defective. Check IC U122 and U123.

(3) Test Button is Pressed but Test Lamp Does Not Light.

Check Q Output of IC U118 (PCB A1). Check if there is a Reset Signal or Set Signal, or if U118 or U132 is broken.

(4) Test Lamp Lights but Measuring Does Not Occur.

Withstanding Voltage Test

1. There is no measuring voltage.
    1. Zero Turn On Switch, or transformer defect or fuse failure.
    2. Z Drive Signal or W Drive Signal defect.
    3. K HW Relay Circuit defect.
2. When NG, Output is Not Cut-Off
    1. Test lamp does not extinguish by Reset button. Reset Circuit or Test Circuit is defective.
    2. Test lamp extinguishes by Reset button, but item 1 written above is defective.
    3. Current Detection Circuit is defective.
    4. Criteria Voltage Generating Circuit.
    5. Comparator.

3. Measurement error is too large
   1. Current Detecton Circuit (includes adjustment error).
   2. Criteria Voltage Generating Circuit (includes adjustment error).

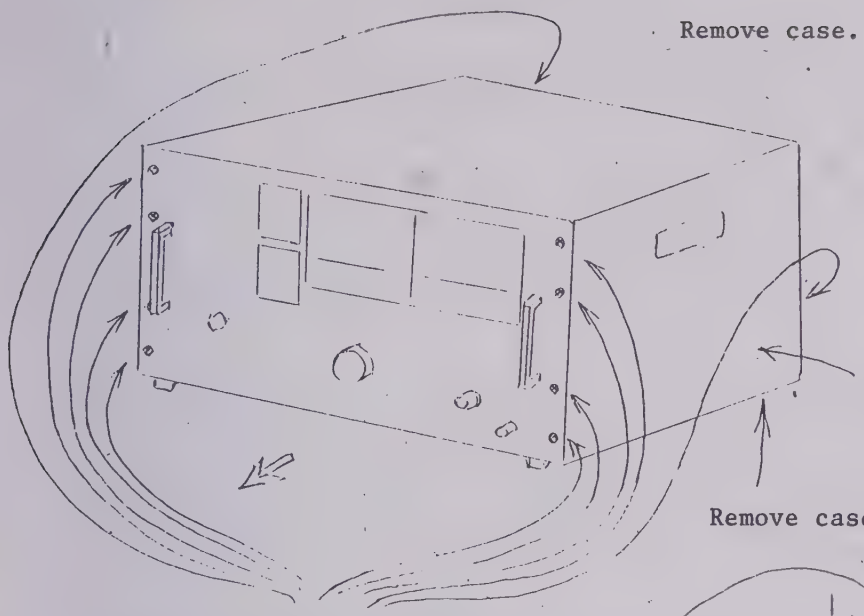
Insulation Resistance Test
1. Meauring Voltage Does Not Output
   1. High Voltage Circuit defect.
   2. I Drive Signal defect.
   3. K H-I Relay Circuit defect.
2. When NG, Output is Not Cut-Off
   1. Test lamp does not turn off by Reset button. Reset Circuit or Test Circuit is defective.
   2. Test lamp turns off by Reset button. Item 1 written above is defective.
   3. Current Detecton Circuit is defective (includes adjustment error).
   4. Criteria Voltage Generating Circuit (includes adjustment error).
   5. Comparator.
3. Measurement error is too large
   1. Current Detection Circuit is defective (includes adjustment error).
   2. Criteria Voltage Generating Circuit (includes adjustment error).

(5) Test Lamp Turns On, Eventhough Test Button has not been Pushed.

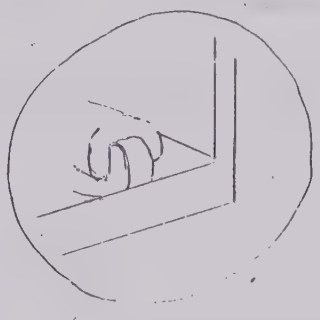
Withstanding Voltage Test
1. Zero Turn On Switch is defective.
2. Test Circuit is defective.

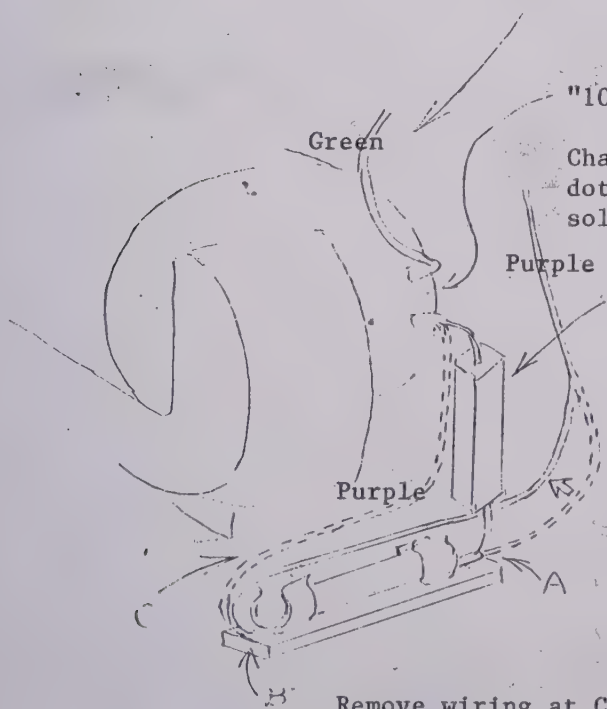
Insulation Resistance Test
1. I Drive Signal is defective.
2. Test Circuit is defective.

Replacing Fuse, for Model 871



Screw locations of case.
Front side - 8 screws, back side - 2 screws. Pull case away in direction of arrow.




"100v" is written here.
Green
Change the wiring from the dotted line position to the solid line position.
Purple
Install a 10Ω 5W cement resistor.
Purple
Remove wiring (dotted line) from point A and connect to point B. It will look like the solid line indicated by the arrow.
A
B
Remove wiring at C, which is connected to B.

Withstanding Voltage Test Voltage Generating Circuit

Select AC voltage from a normal power source or from 874 and add it to the primary side of the high voltage transformer. Output from the secondary side serves as the test voltage.

AC voltage from a normal power source flows thru Zero Turn On Switch, and thru the smooth transformer to high voltage transformer. When a signal from control circuit flows to Control Input of Zero Turn On Switch, the switch is turned on at 0v of AC input sine wave.

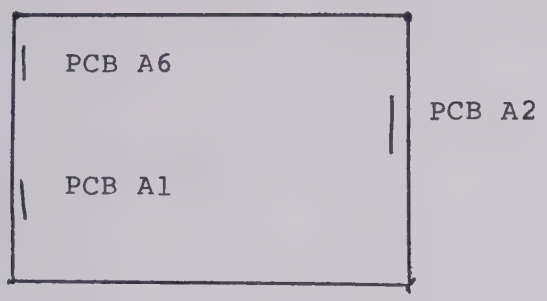
Insulation Resistance Test Voltage Generating Circuit (PCB A2)

Output voltage of transformer at 380v is converted into a direct current by a triple rectifying circuit. This voltage is controlled and stabilized by transistors Q201 and Q202. The stabilizing voltage is output between TP1 and TP2.

Control the voltage between TP1 and the black output terminal and the voltage at TP2 which meets the black output terminal is supplied to the output terminal. This control is done by IC U202 and transistor Q203.

2. Locations of PCB Adjustments

Top View



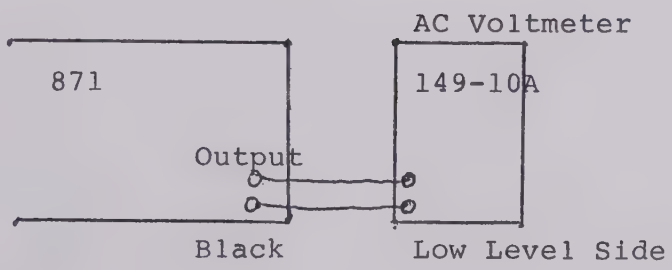
Panel Front

3. Adjustment

Withstanding Voltage Test

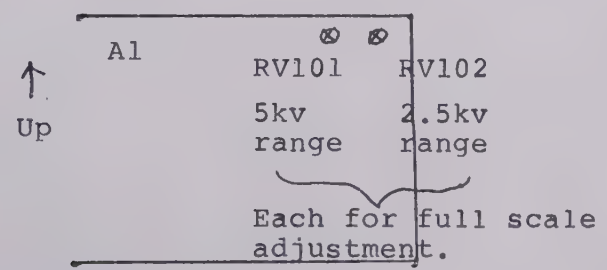
(1) Voltmeter Accuracy

(a) Connecting to Calibrater



(b) Adjustment Points

Above PCB A1

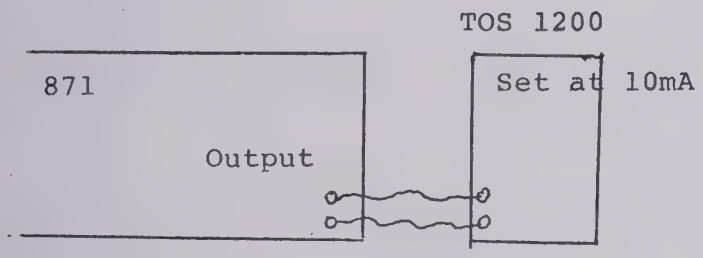


(c) Adjustment

1. Use 2.5kv range for Withstanding Voltage Test.
2. Condition should be "Test On".
3. Output voltage is 2.5kv.
4. Adjust RV101 so that voltmeter display is full scale.
5. Switch over to 5kv range, with "Test On" condition.
6. Set output voltage to 5kv.
7. Adjust RV102 so that voltmeter display is full scale.

(2) Isolated Current Adjustment

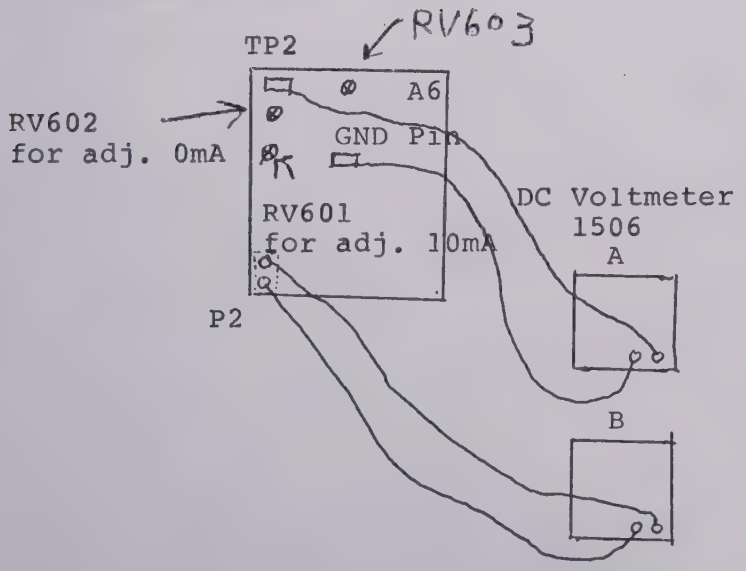
(a) Connecting to Calibrater



Arrangement of AC Voltmeter and Standard Resistor.

Set at 10mA with resistance value at 100k

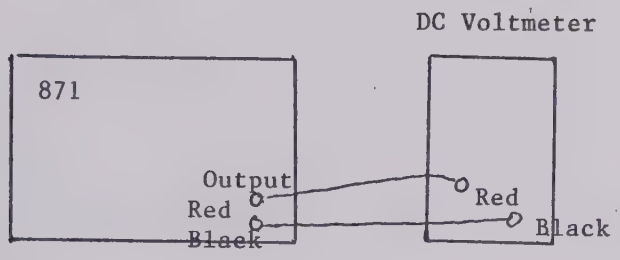
(b) Adjustment Points



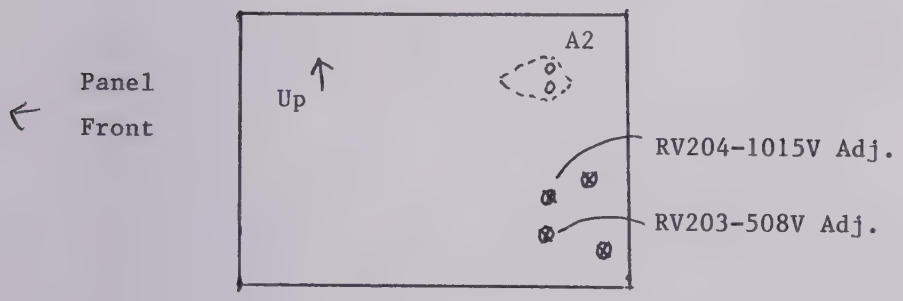
Change connection to A and B and measure.

INSULATION RESISTANCE TEST

(1) Open Voltage Adjustment
(a) Connecting to Calibrater



(b) Adjustment Points
Above the PCB, attached to the right.



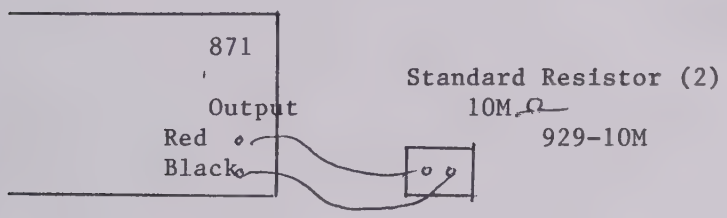
(c) Adjustment

1. Use 1000v range for Insulation Resistance Test.
2. Condition should be "Test On".
3. For calibration, adjust RV204 so that voltmeter display is -1025v.
4. Switch over to 500v range, with "Test On" condition.
5. For calibration, adjust RV203 so that voltmeter display is -513v.

(2) Adjustment for Insulation Resistance Meter

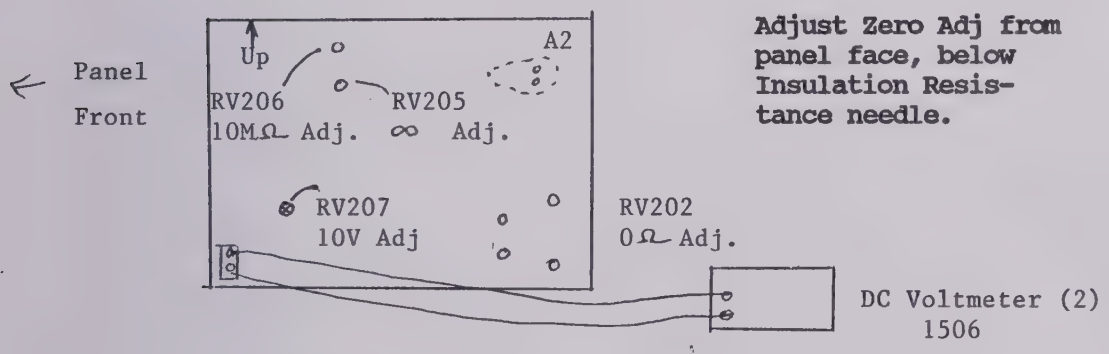
(a) Connecting to Calibrater

This connection is used together with the following diagram in (b).



(b) Adjustment Points

Top view of PCB A2.



Adjust Zero Adj from panel face, below Insulation Resistance needle.

(c) Adjustment

1. Use 100Ω range for Insulation Resistance Test.
2. Use 0.5M standard resistor for calibration.
3. Adjust so that needle of Zero Adj (on panel) indicates 0.5M .
4. Use 10M standard resistor for calibration.
5. Adjust RV206 so that needle indicates 10M .
6. Repeat 3-5 times, unti results are satifactory.
7. Set standard resistor to for calibration.
8. Adjust RV205 so that the inclination of the needle is minimum.
9. Repeat 3-8 times until results are satisfactory.
10. Short the output terminal.
11. Adjust RV202 so that needle indicates 0 .
12. Adjust RV207 so that indication of DC voltmeter (2) is 10v.

To Pag. 14

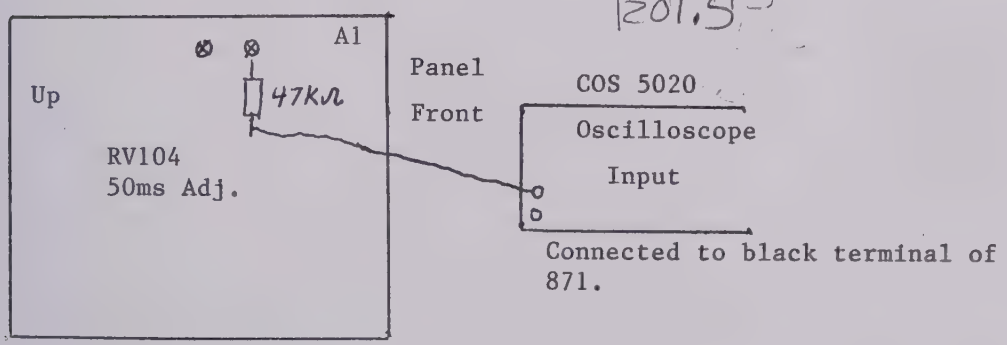
(c) Adjustment

1. Use 2.5kv range for Withstanding Volage Test.
2. Set Cut-Off Current to 10mA.
3. Condition should be "Test On".
4. Gradually increase output voltage and adjust RV601 until output voltage is cut-off at 1000v [for TOS1200 model, error (%) indication is 0].
5. Set Cut-Off Current to 0mA.
6. Connect to A, as shown in item (b) of previous page 14 and measure the voltage of TP2.
7. Condition should be "Test On". If NG occurs soon, adjust RV602, so that NG does not occur.
8. Adjust RV602 so that voltage of TP2 is 3mv +/- 1mv.
9. Repeat 7-8 times until results are satisfactory.
10. Set Cut-Off Current to 10mA and set output voltage to 9.5kv. 10mA Read Voltage. (Volts 0.95) = 1.197kv
11. Connect to B, as shown in item (b) of previous page. Adjust RV603 so that DC voltmeter (2) indicates 9.5v.

(3) Good Signal

(a) Connecting to Calibrater.
Top view of PCB A1.

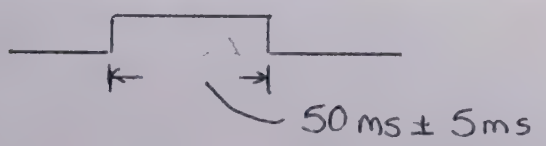
E= 120.15KΩ 10mA = 1201.5V



(b) Adjustment Points
Refer to Connecting to Calibrator diagram.

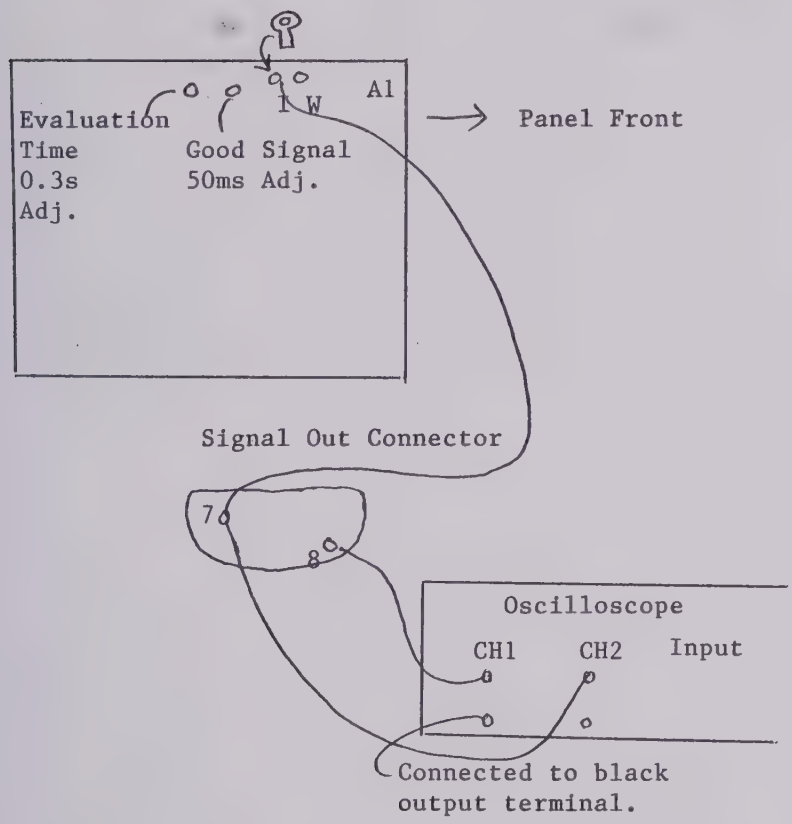
(c) Adjustment

1. Set timer to 1 second, for Withstanding Voltage Test.
2. Pressing the Test button continuously, measure the sine wave.
3. Adjust the 0.3s waiting time of judgement resistor so that the sine wave measured appears as below.



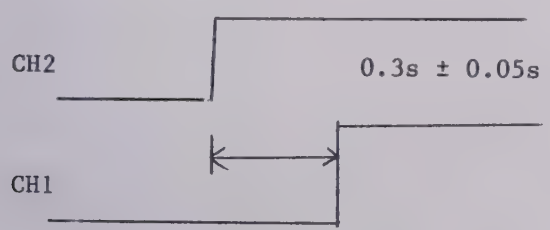
(3) Adjustment of Evaluation Time

(a) Adjustment Points and Connecting to Calibrator



(b) Adjustment

1. For the Insulation Resistance Test, short at the measuring terminals (black and red terminals on the front of the panel) and test so that the result is NG.
2. Observe the wave pattern when the Test button is pressed.
3. Adjust the resistor for evaluating time 0.3s so that the observed wave pattern is as shown below.



BUHCOD	QTY	UN	BUHINMEI	(DRW-NO.)	DRAW-NO.
91-80-0902	1	EA	WIRE KIT CONNECTOR 5251-04 4P	S8103323	
91-80-0913	2	EA	WIRE KIT CONNECTOR 5251-02 2P 700MM		S8108061
91-80-0914	1	EA	WIRE KIT CONNECTOR 5251-02 2P 1050MM		S8202411
92-01-1010	23	EA	TMEV1.25-4 INSULATED CRIMP TERMINAL(U,C)		
92-01-1030	3	EA	TMEV1.25-6 INSULATED CRIMP TERMINAL RED		
92-11-1000	2	EA	STK-A1 STEATITE TERMINAL		
92-11-3000	3	EA	RGKA-3 TYPE B STEATITE TERMINAL		
95-00-0110	1	EA	EB2314 BUZZER,DC24V		
97-01-0130	2	EA	VHP TIMER,DC24V,999SEC	S8004962	
99-00-0111	1	EA	FUSE-7A F-7161 (6.4-30)		
99-02-0100	1	EA	FUSE 0.5A FGT41 250V S.B 6.4X31.8		S8407312

TOTAL RECORDS 337

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	BUHCOD	QTY	UN	BUHINMEI	(DRW-NO.)	DRAW-NO.
	A1-209-901	1	EA	PANEL FRONT 871	3140443	236393
					N104443	
	A2-209-901	1	EA	PANEL REAR 871	3140462	236413
					N104463	
	A6-516-021	1	EA	NAME PLATE(CAUTION HIGH VOLTAGE)	491772	N434341
	A8-000-391	1	EA	SEAL FUSE 0.5A (S.B)		N443811
					4149231	
	A8-210-201	1	EA	SEAL CAUTION FOR TOS8XXX	3163851	N352851
	A8-210-202	1	EA	SEAL H.V DANGER FOR TOS8XXX	3163861	N352861
	A8-909-001	1	EA	SEAL HTL-1.5W	4191471	N453411
	B3-020-011	1	EA	PLATE TOP 860A	3131682	
	B4-020-011	1	EA	PLATE BOTTOM 872/873	3131691	
	B7-209-601	2	EA	SIDE PLATE 860A	3130273	
	C3-209-901	1	EA	CHASSIS 871	314756B3	
	C3-209-902	1	EA	PLATE SIDE-L 871	3147542	
	C3-209-903	1	EA	PLATE SIDE-R 871	3147552	
	C7-268-011	1	EA	FRAME (FRONT) 860	398893	
	C7-268-021	1	EA	FRAME (REAR) 860	398904	
	D3-268-031	1	EA	STAY (REAR) 860	3181201	
	E1-268-011	2	EA	RAIL 860	4137453	
	E3-070-101	1	EA	SHORT BAR	431514	
	E6-070-021	2	EA	HANDLE THA-158-Z-CR-1 CODE 3847		
	H1-070-241	1	EA	HEAT SINK H-090	4116471	
	H1-268-021	1	EA	HEAT SINK 860	4154001	
	K5-000-022	2	EA	12/20 BINDING POST METAL	4133081	
	K5-210-401	1	EA	18/28 BINDING POST METAL TOS8650	4218801	
	L3-020-111	8	EA	SPACER HEXAGON 3-30 (-8,-8)	458891	
	L3-020-221	3	EA	SPACER HEXAGON 6-12	4164552	
	L3-021-021	5	EA	SPACER HEXAGON 3-9 (-5.5,+5)	417313	
	L3-021-031	3	EA	SPACER HEXAGON 3-11 (-7,+5)	482542	
	L3-021-061	4	EA	SPACER HEXAGON 3-20 (-6,+8)	441861	
	L3-209-601	4	EA	SPACER HEXAGON 4-13	4178871	
	L4-211-201	1	EA	TERMINAL GND (HEXAGON)	4223362	4223373
Y	M2-000-051	13	EA	BIND SCREW M2.6X0.45X8 B-NI		
Y	M2-000-101	2	EA	BIND SCREW M3X0.5X10 B-NI		
Y	M2-000-421	2	EA	BIND SCREW M4X0.7X16 B-NI		
Y	M2-001-091	4	EA	SARA SCREW M3X0.5X8 S-ZN		
Y	M2-001-151	4	EA	SARA SCREW M4X0.7X8 S-ZN		

	BUHCOD	QTY	UN	BUHINMEI	(DRW-NO.) DRAW-NO.
Y	M2-002-041	6	EA	MARU-SARA SCREW M3X0.5X8 B-NI	
Y	M2-002-051	4	EA	MARU-SARA SCREW M3X0.5X10 B-NI	
Y	M2-002-071	8	EA	MARU-SARA SCREW M4X0.7X10 B-NI	
Y	M2-002-091	8	EA	MARU-SARA SCREW M5X0.8X14 B-NI	
Y	M2-002-111	4	EA	MARU-SARA SCREW M4X0.7X14 B-NI	
Y	M2-002-161	4	EA	MARU-SARA SCREW M2.6X0.45X6 B-NI	
Y	M2-002-171	4	EA	MARU-SARA SCREW BLACK M3X0.5X12	
	M2-002-191	4	EA	MARU-SARA SCREW M5X0.8X20 B-NI	
Y	M2-010-091	8	EA	NABE SCREW M5X0.8X12 S-ZN	
Y	M3-000-011	2	EA	SEMS-PW BIND SCREW M3X0.5X6 B-NI	
Y	M3-001-111	6	EA	SEMS-SW BIND SCREW M4X0.7X8 B-NI	
Y	M3-002-061	4	EA	DOUBLE SEMS-K BIND SCREW M3X0.5X8 B-NI	
Y	M3-011-011	6	EA	SEMS-SW NABE SCREW M3X0.5X6 S-ZN	
Y	M3-011-031	4	EA	SEMS-SW NABE SCREW M3X0.5X10 S-ZN	
Y	M3-011-081	2	EA	SEMS-SW NABE SCREW M4X0.7X10 S-ZN	
Y	M3-012-011	15	EA	DOUBLE SEMS SCREW M3X0.5X6 S-ZN	
Y	M3-012-111	4	EA	DOUBLE SEMS SCREW M4X0.7X16 S-ZN	
Y	M4-000-021	8	EA	NUT HEXAGON M2.6NX0.45 B-NI	
Y	M4-000-031	2	EA	NUT HEXAGON M3NX0.5 B-NI	
Y	M4-000-041	2	EA	NUT HEXAGON M4NX0.7 B-NI	
	M4-000-061	3	EA	NUT HEXAGON M6NX1 B-NI	
Y	M4-010-021	24	EA	FLANGE NUT HEXAGON M3X0.5 S-ZN	
Y	M4-010-031	4	EA	FLANGE NUT HEXAGON M4X0.7 S-ZN	
Y	M4-010-041	4	EA	FLANGE NUT HEXAGON M5X0.8 S-ZN	
Y	M5-000-031	2	EA	WASHER M3W B-NI	
Y	M5-000-041	2	EA	WASHER M4W B-NI	
	M5-000-061	3	EA	WASHER M6W B-NI	
Y	M5-001-021	11	EA	SPRING WASHER 2.6 SW B-NI	
Y	M5-001-031	2	EA	SPRING WASHER 3 SW B-NI	
Y	M5-001-041	4	EA	SPRING WASHER 4 SW B-NI	
	M5-001-061	3	EA	SPRING WASHER 6 SW B-NI	
Y	M5-003-031	8	EA	CUP WASHER 5 CW	428272
	M5-010-051	4	EA	WASHER M5W S-ZN	
	M5-011-051	8	EA	SPRING WASHER 5SW S-ZN	
	M6-000-151	1	EA	EARTH LUG 6DIA	4126251
	M8-000-011	2	EA	12-KAKU NUT	451732
	M8-020-011	3	EA	KAZARI NUT 860A	4164542
	N1-000-011	1	EA	KNOB D22SB (BLACK)	

BUHCOD	QTY	UN	BUHINMEI	(DRW-NO.)	DRAW-NO.
N1-000-171	1	EA	ROUND KNOB R12SB-3.2 BLACK	4145023	
N1-000-221	1	EA	DIAL KONB D39SB	3146801	
N6-000-061	2	EA	BINDING POST 12/20 KNOB WHITE	4126211	4126242
N6-000-071	2	EA	BINDING POST 12/20 BASE	4126221	
N8-000-021	1	EA	BINDING POST 18-28 BLACK	476761	
P2-000-041	1	EA	BASE 14-25-23	434491	
P2-000-301	1	EA	H.V TERMINAL BASE 865A	4159113	
P2-000-311	1	EA	H.V TERMINAL KNOB 865A	4159101	476791
P3-265-011	1	EA	BRACKET RED B-114-1		
P4-000-271	4	EA	SHILD TANMATSU CAP GREEN 313015		
P4-000-291	2	EA	SHILD TANMATSU CAP YELLOW 313015A		
P4-000-551	50	EA	SK-BINDER SKB-1 (UL)		
P4-050-041	1	EA	STRAIN RELIEF BUSHING SR-5P-4 (UL CSA)		
P4-305-021	12	EA	PETEPPRU M GATA		
P5-000-171	4	EA	FOOT RUBBER 32/15 K-3215	4207182	
Q4-206-801	1	EA	BARRIER 860	4154191	
Q5-265-012	1	EA	BARRIER	4177454	
R6-000-101	1	EA	POLY-BUKURO #10 (500D-235W-520H)	31832C1	
R6-000-261	1	EA	UNI-PACK 170X240	4137272	N344171
X1-000-111	1	EA	MP-5 TRANSISTOR MOUNTING PAD		
X1-000-181	11	EA	LH-11 HOLDER FOR RLD7 LED		
Z1-209-910	1	EA	OPERATION MANUAL (J) 871		
Z5-268-011	1	EA	CARTON 860	3101772	4140471
				4140481	
23-24-0000	1	EA	110V,T-10,E-10 LAMP FILAMENT		
24-00-0040	1	EA	Y08-2100B TUBE ARRESTER		
30-11-0151	13	EA	2SA1015-Y PNP TRANSISTOR (50V,0.4W)		
30-31-7751	2	EA	2SC1775-E (HFE=400-800)		
30-31-8151	8	EA	2SC1815-Y (50V,150MA,0.4W)		
30-31-9421	1	EA	2SC1942 WITH ACCESSORY		
30-33-6760	1	EA	2SC3676 1500V 0.3A 20W		
30-40-6671	2	EA	2SD667A-C (HFE 60-120)		
30-90-0100	1	EA	UPA38A		
30-90-0160	4	EA	UPA67C,NPN 6TR ARRAY DIP-14P		
32-11-5880	64	EA	1S1588 DIODE VF=30V IF=0.5A P=300MW		
32-11-8320	3	EA	1S-1832 VRM1.8KV FAST RECOVERY		
32-90-0523	19	EA	S5277J DIODE 600V 1A		
32-90-0550	1	EA	V11M DIODE		

BUHCOD	QTY	UN	BUHINMEI	(DRW-NO.) DRAW-NO.
32-90-0940	2	EA	S1VB20 BRIDGE DIODE	
32-92-0056	1	EA	RD5.6JS-B2 (5.49-5.73V) 0.4W	
32-92-0075	1	EA	RD7.5JS-B (7.06-7.84V) 0.4W	
32-92-0082	2	EA	RD8.2JS-B (7.76-8.64V) 0.4W	
32-92-0110	2	EA	RD11JS-B (10.44-11.56V) 0.4W	
32-92-0150	1	EA	RD15JS-B2 (14.34-14.98V) 0.4W	
32-92-0160	2	EA	RD16JS-B1 (15.37-16.01V) 0.4W	
32-93-0129	2	EA	HZ12B-1L 12.4-12.9V	
34-00-0000	1	EA	LM301AH OP-AMP-IC	
34-00-0010	1	EA	LM308H OP-AMP-IC	
34-00-0090	3	EA	UPC741C IC	
34-00-0215	2	EA	TL081CP J-FET INPUT OP AMP	
34-00-0240	7	EA	UPC 4558C DUAL OP-AMP-IC	
34-10-0000	1	EA	TL068CLP VOLTAGE FOLLOWER AMP	
34-40-0070	1	EA	TA7179P (DUAL +/_15V TRACKING RAGULATOR)	
34-40-0340	1	EA	UA7915UC -15V 1A	
34-40-0350	1	EA	TA78015AP +15V 1A	
34-69-0010	1	EA	TC4066BP QUAD BILATERAL SWITCH	
35-60-0040	4	EA	TC4030BP QUAD EXCLUSIVE OR	
35-60-0070	4	EA	MC14071BCP QUAD 2-INPUT OR GATE	
35-60-0110	8	EA	MC14069UBCP HEX INVERTER	
35-60-0130	1	EA	MC14043BCP QUAD NOR R-S LATCH	
35-60-0140	6	EA	MC14081BCP QUAD 2-INPUT AND GATE	
35-60-0230	1	EA	MC14012BCP DUAL 4-INPUT NAND GATE	
35-60-0240	1	EA	MC14572UBCP HEX GATE	
35-63-0000	4	EA	MC14013BCP DUAL D FLIP FLOP	
35-63-0010	1	EA	MC14027BCP DUAL J-K FLIP FLOP	
35-69-0000	6	EA	MC14519BCP 4-BIT AND/OR SELECTOR	
37-00-0082	6	EA	TLR102KW LED-LMP-RED-WITH HOLDER	
37-00-0130	7	EA	RLD7-237PDS LED RED	
37-00-0160	3	EA	RLD7-337ADS LED AMBER	
37-00-0170	1	EA	RLD7-537PDS LED GREEN	
39-00-0140	1	EA	ERZ-C10DK 680 SURGE ABSORBER	
39-00-0150	1	EA	ERZ-C10DK 220 SURGE ABSORBER	
39-00-0200	1	EA	TNR 123K010 SURGE ABSORBER 12KV	
39-90-0030	1	EA	D2W-5003 ZERO CROSS SWITCH (30-60121)	
40-27-0000	45	EA	NAS1/4 0 OHM JUMPER PARTS	
40-27-0222	2	EA	NAS1/4S22 OHM J RESIST,FIX,CAR	

	BUHCOD	QTY	UN	BUHINMEI	(DRW-NO.) DRAW-NO.
	40-27-1102	4	EA	NAS1/4S100 OHM J RESIST,FIX,CAR	
	40-27-1222	2	EA	NAS1/4S220 OHM J RESIST,FIX,CAR	
	40-27-1332	1	EA	NAS1/4S330 OHM J RESIST,FIX,CAR	
	40-27-1472	34	EA	NAS1/4S470 OHM J RESIST,FIX,CAR	
	40-27-1562	2	EA	NAS1/4S560 OHM J RESIST,FIX,CAR	
	40-27-1682	1	EA	NAS1/4S680 OHM J RESIST,FIX,CAR	
	40-27-1822	1	EA	NAS1/4S820 OHM J RESIST,FIX,CAR	
	40-27-2102	7	EA	NAS1/4S1K OHM J RESIST,FIX,CAR	
	40-27-2222	1	EA	NAS1/4S2.2K OHM J RESIST,FIX,CAR	
	40-27-2272	1	EA	NAS1/4S2.7K OHM J RESIST,FIX,CAR	
	40-27-2332	1	EA	NAS1/4S3.3K OHM J RESIST,FIX,CAR	
	40-27-2392	1	EA	NAS1/4S3.9K OHM J RESIST,FIX,CAR	
	40-27-2472	3	EA	NAS1/4S4.7K OHM J RESIST,FIX,CAR	
	40-27-2562	5	EA	NAS1/4S5.6K OHM J RESIST,FIX,CAR	
	40-27-2682	2	EA	NAS1/4S6.8K OHM J RESIST,FIX,CAR	
	40-27-2822	2	EA	NAS1/4S8.2K OHM J RESIST,FIX,CAR	
	40-27-3102	22	EA	NAS1/4S10K OHM J RESIST,FIX,CAR	
	40-27-3152	5	EA	NAS1/4S15K OHM J RESIST,FIX,CAR	
	40-27-3222	57	EA	NAS1/4S22K OHM J RESIST,FIX,CAR	
	40-27-3272	5	EA	NAS1/4S27K OHM J RESIST,FIX,CAR	
	40-27-3392	1	EA	NAS1/4S39K OHM J RESIST,FIX,CAR	
	40-27-3472	48	EA	NAS1/4S47K OHM J RESIST,FIX,CAR	
	40-27-3562	1	EA	NAS1/4S56K OHM J RESIST,FIX,CAR	
	40-27-3682	4	EA	NAS1/4S68K OHM J RESIST,FIX,CAR	
	40-27-4102	7	EA	NAS1/4S100K OHM J RESIST,FIX,CAR	
	40-27-4152	2	EA	NAS1/4S150K OHM J RESIST,FIX,CAR	
	40-27-4222	11	EA	NAS1/4S220K OHM J RESIST,FIX,CAR	
	40-27-5102	4	EA	NAS1/4S 1M OHM J RESIST,FIX,CAR	
	40-37-2681	6	EA	RD1/2PXJ6.8K OHM RESIST,FIX,CAR	
#	40-37-3181	1	EA	RD1/2PXJ18K OHM RESIST,FIX,CAR	
	40-37-4681	4	EA	RD1/2PXJ680K OHM RESIST,FIX,CAR	
	40-37-5101	9	EA	RD1/2PXJ1M OHM RESIST,FIX,CAR	
	40-37-6101	2	EA	RD1/2PXJ10M OHM RESIST,FIX,CAR	
	42-57-0030	1	EA	RH3HVS 20M OHM J RESIST,FIX	
	42-57-0150	1	EA	RH2HVS 10M OHM J RESIST,FIX	
	42-57-0180	1	EA	RH3HVS 1000M OHM J RESIST,FIX	
	42-71-2800	1	EA	CM1/4 8K OHM D	
	42-71-2900	1	EA	CM1/4 9K OHM D	

BUHCOD	QTY	UN	BUHINMEI	(DRW-NO.) DRAW-NO.
42-71-3100	2	EA	CM1/4 10K OHM D	
42-71-3200	1	EA	CM1/4 20K OHM D	
42-71-3400	1	EA	CM1/4 40K OHM D	
42-71-3800	1	EA	CM1/4 80K OHM D	
42-71-3900	1	EA	CM1/4 90K OHM D	
42-71-4100	1	EA	CM1/4 100K OHM D	
42-71-4200	1	EA	CM1/4 200K OHM D	
42-72-1100	1	EA	CM1/4 100 OHM F	
42-72-1120	1	EA	CM1/4 120 OHM F	
42-72-1470	3	EA	CM1/4 470 OHM F	
42-72-2100	1	EA	CM1/4 1K OHM F	
42-72-2390	1	EA	CM1/4 3.9K OHM F	
42-72-2560	1	EA	CM1/4 5.6K OHM F	
42-72-2680	1	EA	CM1/4 6.8K OHM F	
42-72-3100	1	EA	CM1/4 10K OHM F	
42-72-3120	2	EA	CM1/4 12K OHM F	
42-72-3150	4	EA	CM1/4 15K OHM F	
42-72-3200	1	EA	CM1/4 20K OHM F	
42-72-3220	5	EA	CM1/4 22K OHM F	
42-72-3300	4	EA	CM1/4 30K OHM F	
42-72-3330	1	EA	CM1/4 33K OHM F	
42-72-4120	2	EA	CM1/4 120K OHM F	
42-73-0402	2	EA	CM1/2 40.2 OHM D	
42-73-1604	1	EA	CM1/2 604 OHM D	
42-73-4400	1	EA	CM1/2 400K OHM D	
42-74-4800	1	EA	CM1/2 800K OHM F	
42-74-5100	1	EA	CM1/2 1M OHM F	
43-87-0240	1	EA	RWH20G 50HM J (OS) RESIST,FIX,WW	
44-07-0000	9	EA	TNB07F223J-22K OHMX6 (4BBS5170) R-NET.	
44-07-0030	4	EA	TNA05A683J-68K OHMX4	
44-27-0000	1	EA	RP 1/4J 1K OHM (4000PPM/DEG)	
44-55-0000	1	EA	MOR-3B 150K OHM G	
44-91-2100	1	EA	MOR-1B 1K OHM J	
44-91-2120	1	EA	MOR-1B 1.2K OHM J	
44-91-2150	5	EA	MOR-1B 1.5K OHM J RESIST FIX	
44-92-1100	2	EA	MOR-2B 100 OHM J	
44-92-1470	2	EA	MOR-2B 470 OHM J	
44-92-1820	2	EA	MOR2B 820 OHM J RESIST,FIX	

BUHCOD	QTY	UN	BUHINMEI	(DRW-NO.) DRAW-NO.
44-96-2330	2	EA	MOR-7B 3.3K OHM J	
46-16-2201	1	EA	RG161P 15S B 2K OHM	
46-16-3101	3	EA	RG161P 15S B 10K OHM	
48-32-2200	3	EA	TM64K2(PV) B 2K OHM	
48-32-2500	1	EA	TM64K2(PV) B 5K OHM	
48-32-3100	4	EA	TM64K2(PV) B 10K OHM	
48-32-4500	2	EA	TM64K2(PV) B 500K OHM	
48-33-1200	1	EA	TM64K3(PV2) B 200 OHM	
48-33-2100	1	EA	TM64K3(PV2) B 1K OHM	
48-33-2500	1	EA	TM64K3(PV2) B 5K OHM	
48-33-3100	1	EA	TM64K3(PV2) B 10K OHM	
48-33-3500	2	EA	TM64K3(PV2) B 50K OHM	
48-33-4100	1	EA	TM64K3(PV2) B 100K OHM	
50-65-5500	2	EA	B32511-D1105-J 1.0MF(J) 100V DC	
50-65-5540	1	EA	B32512-E1225-J 2.2MF(J) 100V DC	
50-65-5570	1	EA	B32510-D1474-J 0.47MF(J) 100V DC	
50-67-0040	1	EA	CQ92MC 1H/2A 223K 0.022MF K% CAP,POLYEST	
52-01-2265	3	EA	ECK-F1H221KB CERAMIC 220PF(K)50WV	
52-01-2345	11	EA	ECK-F1H102KB CERAMIC 1000PF(K)50WV	
52-03-3469	8	EA	ECK-D2H103PU 0.01MF CERAMIC	
52-05-1498	32	EA	ECK-F1E104ZF CERAMIC 0.1MF(Z)25WV	
52-05-2468	85	EA	ECK-F1H103ZF CERAMIC 0.01MF(Z)50WV	
54-00-0301	17	EA	SM50VB-1 50WV1MF,5X11 *407089*	
54-00-0303	4	EA	SM50VB-3R3 50WV3.3MF,5X11	
54-00-0311	10	EA	SM50VB-10 50WV10MF,5X11 *407488*	
54-00-0314	2	EA	SM50VB-47 50WV47MF,8X12 *407780*	
54-00-0321	1	EA	SM50VB-100 50WV100MF,10X16 *470996*	
54-30-1640	2	EA	SM35VB-2200 CAP,ELECT 35WV 2200MF	
54-80-1020	8	EA	350VB-4.7 CAP,ELECT 350WV4.7MF	
56-48-1010	8	EA	B5RC0127-32N 0.01MF X4 FZ C-NET	
60-16-0160	1	EA	PT 8850 (100V)	S8005102 S8005113 S8005123 S8005132
60-51-0102	1	EA	PT(H.V) FOR 871 LOW INDUCTANCE (5KV)	S8400042 S8400053 3181803
61-16-0010	1	EA	TRANS,SLIDE	S7401134 S7401142
70-03-0282	1	EA	2076,METER,(5/2.5KV AC)	S8208582
70-03-0294	1	EA	2076,METER,(500M OHM/1000V)	S7901193 S7901201 S7901211

BUHCOD	QTY	UN	BUHINMEI	(DRW-NO.) DRAW-NO
71-07-0171	6	EA	LZ 24S,DC24V RELAY 1 TRANSFER	
71-07-0180	2	EA	MZ24HS ,DC24V	
71-09-0130	4	EA	VS-24STBN,DC24V RELAY,1T 1100 OHM	
71-90-0000	2	EA	ZV6K-015ACS,HV RELAY	S8106481
80-98-0080	1	EA	SR26N 1-2-4 20R ROTARY SWITCH(SR26-2922)	
82-11-0070	1	EA	V-15-1A5(WITH VAQ-4B-K) SWITCH MICRO	
82-11-0090	1	EA	V-15-1A5(WITH VAQ-4R-K) SWITCH MICRO	
82-31-0080	2	EA	8C1011 TOGGLE SWITCH	
82-31-0260	2	EA	M-2012V SWITCH TOGGLE (FOR PCB)	
82-31-0270	1	EA	M-20208H SWITCH TOGGLE (FOR PCB)	
82-32-0030	2	EA	S-6A SWITCH,TOGGLE	
82-61-0000	3	EA	DP101-C-S DIGITAL SW UNIT	
82-61-0001	1	EA	DP100-01 SIDE COVER FOR DP101	
83-10-4020	1	EA	SCK-1604-R CONNECTOR,RECEPTACLE	
83-10-5020	1	EA	D5-701B-00 TYPE 5F DIN SOCKET	
83-10-6040	1	EA	SCK-1606-R CONNECTOR	
83-10-8010	3	EA	D8-701B-00 DIN CONNETOR SOCKET	
83-21-4000	1	EA	57-30140 AMPHENOL PLUG	
83-21-4010	3	EA	57-40140 AMPHENOL RECEPTACLE	
84-24-0030	11	EA	ICC 05-008-360T IC SOCKET 8P	512508
84-27-0020	34	EA	ICC 05-014-360T IC SOCKET 14P	512516
84-28-0020	9	EA	ICC 05-016-360T IC SOCKET 16P	512524
84-51-0000	1	EA	AF007,FUSE HOLDER,(SHONIN NO,AF007-A02)	
84-51-0060	1	EA	X-N1157-01 HOLDER FUSE	
84-80-0001	11	EA	5167TL CONNECTION CRINP TYPE TERMINAL	
84-80-0006	150	EA	5659PBT2L CRIMP TYPE TERMINAL	
84-80-0100	1	EA	2390V-2 CRIMP TYPE HOUSING	
84-80-0101	1	EA	2390V-3 CRIMP TYPE HOUSING	
84-80-0104	1	EA	2390V-6 CRIMP TYPE HOUSING	
84-80-0166	3	EA	5250-10 HOUSING 2.5-10	
84-80-0169	1	EA	5250-20 HOUSING 2.5-20	
84-80-0180	2	EA	5251-02 HOUSING 2.5-2 WITH LOCK	
84-80-0200	5	EA	5287-2A FLAT WAFER ASSEMBLY 5-02	
84-80-0201	1	EA	5287-3A FLAT WAFER ASSEMBLY 5-03	
84-80-0204	1	EA	5287-6A FLAT WAFFR ASSEMBLY 5-06	
84-80-0253	3	EA	3022-05A FLAT WAFER ASSEMBLY 2.5-5	
84-80-0254	1	EA	3022-06A FLAT WAFER ASSEMBLY 2.5-6	
84-80-0255	5	EA	3022-08A FLAT WAFER ASSEMBLY 2.5-8	

BUHCOD	QTY	UN	BUHINMEI	(DRW-NO.)	DRAW-NO.
84-80-0256	7	EA	3022-10A FLAT WAFER ASSEMBLY 2.5-10		
84-80-0259	2	EA	3022-20A FLAT WAFER ASSEMBLY		
84-80-0270	14	EA	5045-02A FLAT WAFER ASSEMBLY 2.5-2 LOCK		
84-80-0271	2	EA	5045-03A FLAT WAFER ASSY 2.5-3 LOCK UL		
84-80-0272	1	EA	5045-04A FLAT WAFER ASSY 2.5-4 LOCK UL		
84-80-0809	2	EA	3022-12A FLAT WAFER ASSEMBLY 2.5-12		
85-10-0040	1	EA	PLUG,WITH VFK CORD,GRAY (2.5M)		
87-40-0040	17	EA	RT-08T-1.3B DIAMOND CONNECTOR PIN		
87-40-0060	4	EA	SDF-01T-1.3AS DIAMOND CONNECTOR CONTACT		
89-01-0020	1	EA	HTL-1.5 W, HV TEST LEAD	376893	4114473
				4114183	
89-04-0040	1	EA	E5-724D-00 DINCORD(BLACK) 1.5M (A3244)		
89-04-0042	2	EA	E8-724D-607 DINCORD BLACK(1.5M) A3738		
90-20-1790	1	EA	PCB-D 871 A1 SEQUENCE,MAIN	N241744	239204
				N241754	239215
				N246741	251051
90-20-1800	1	EA	PCB-S 871 A2 I.TESTER	N241766	239228
				N246751	251061
90-20-1810	1	EA	PCB-S 871 A3 RELAY	N242541	240861
				N246761	251071
90-20-1820	1	EA	PCB-S 871 A4 LED	N450241	4177861
				N457141	4203741
90-20-1830	1	EA	PCB-S 871 A5 VR AND SW	N450231	4177851
				N457151	4203751
90-20-1840	1	EA	PCB-D 871 A6 DAC	N350214	3148474
				N350224	3148485
				N356631	3183591
91-80-0011	1	EA	WIRE KIT CONNECTOR 1P BRN 700MM	S8202421	
91-80-0050	3	EA	WIRE KIT CONNECTOR 5250-05 5P	S7819912	
91-80-0061	1	EA	WIRE KIT CONNECTOR 5250-06 6P 700MM		S8202361
91-80-0080	3	EA	WIRE KIT CONNECTOR 5250-08 8P	S7819943	
91-80-0081	2	EA	WIRE KIT CONNECTOR 5250-08 8P 700MM		S8202371
91-80-0100	3	EA	WIRE KIT CONNECTOR 5250-10 10P	S7819963	
91-80-0101	1	EA	WIRE KIT CONNECTOR 5250-10 10P 700MM		S8202381
91-80-0120	2	EA	WIRE KIT CONNECTOR 5250-12 12P	S8108031	
91-80-0201	1	EA	WIRE KIT CONNECTOR 5250-20 20P 700MM		S8202401
91-80-0900	8	EA	WIRE KIT CONNECTOR 5251-02 2P	S8103303	
91-80-0901	2	EA	WIRE KIT CONNECTOR 5251-03 3P	S8103313	

CALIBRATION & CONFIRMATION
OF
KIKUSUI 871

EQUIPMENT NEEDED:

1. FLUKE DMM (STANDARD 003)
2. KIKUSUI HIGH VOLTAGE METER, 149-10A (STANDARD 005)
3. RESISTANCE BOX: AKEI 90273, 90274, 90275
4. DIGITAL STORAGE O-SCOPE
5. CALCULATOR
6. MINIATURE SCREWDRIVER
7. 100V AC TRANSFORMER (AT DEGAUSSING STATION)

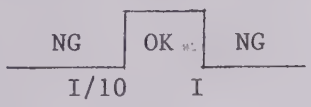
RUN TEST MEANS TO PRESS RESET, 5 FIG. 1, THEN PRESS TEST BUTTON, 6 FIG.1.

PROCEDURE:

1. MEASURE THE 100 V AC TRANSFORMER OUTPUT TO THE 871 TO ENSURE THAT IT IS 100V AC +/-10% USING THE FLUKE DMM.
2. TURN ON THE EQUIPMENT FOR 30 MINUTE WARM UP, THEN TURN OFF THE 871, AND NOTE ITS SETTINGS.
3. CALIBRATE THE 871 HIGH VOLTAGE METER:
   - A. WITH THE 871 OFF, CHECK THAT ITS H.V. METER IS ZERO, IF NOT ADJUST BY THE SCREW BELOW THE H.V. METER.
   - B. SET THE 149-10A TO MEASURE AC.
   - C. CONNECT THE H.V. OUPUT OF THE 871 TO 149-10A TO MEASURE THE AC VOLTAGE.
   - D. SET SWITCH "W TEST RANGE", (23 FIG.1) ON THE 871 TO 2.5 KV; SET THE "FUNCTION" SWITCH (2 FIG.1) TO W TEST MANUAL TEST; TURN THE TIMER OFF.
   - E. TURN ON THE 871, RUN TEST (PRESS THE RESET BUTTON THEN THE TEST BUTTON)
   - F. ADJUST THE "TEST VOLTAGE" CONTROL, (8 FIG.1) UNTIL THE H.V. METER READS "X" ON 2.5 KV SCALE. THE INDICATION ON THE 149-10A SHOULD BE WITHIN +/-3% of "X" (0.97*X IS LESS THAN OR = 149-10A IS LESS THAN OR EQUAL TO 1.03*X)
     X=(0.5KV, 1.0KV, 1.5KV, 2.0KV, 2.5KV)
   - G. SET THE HV TO 0.5KV AND TURN THE 871 OFF, DISCONNECT THE 149-10A.

4. LEAKING CURRENT

LEAKAGE CURRENT HAS A WINDOW OF OPERATION,
I/10 TO I, (I= CURRENT IN ma)



A. TURN THE 871 OFF

B. REMOVE THE SHORTING BAR (21 FIG.1) TO LEAKAGE TERMINALS

C. SET THE FLUKE DMM TO MEASURE AC CURRENT AND PRESS OFFSET.

D. CONNECT THE FLUKE TO THE LEAKAGE CURRENT TERMINALS.

E. CONNECT THE RRB (AKEI 90274), TO THE H.V. OUTPUT OF THE 871, AND SET THE RRB TO 180K OHM POSITION.

F. SET "LOWER" SWITCH OFF (22 FIG.1).

G. SET LEAKAGE CURRENT (18 FIG.1) TO 6 ma.

H. TURN ON THE 871.

I. RUN TEST FOR EACH VALUE OF X.

J. SET THE CURRENT TO "X" (TABLE 4-1) ON THE FLUKE BY SLOWLY ADJUSTING, THE "TEST VOLTAGE" (8 FIG.1). OBSERVE THAT THE "NG" LAMP GIVES THE PROPER INDICATION FOR TABLE 4-1.

X	5.70ma	5.80ma	6.20ma	6.30ma
NG LAMP	OFF	ON/OFF	ON/OFF	ON

TABLE 4-1 RESULTS MUST BE LESS THAN 5%

K. TURN ON "LOWER" SWITCH (22 FIG.1)

L. REPEAT STEP J USING TABLE 4-2

X	0.74ma	0.68ma	0.56ma	0.50ma
NG LAMP	OFF	ON/OFF	ON/OFF	ON

TABLE 4-2 RESULTS MUST BE LESS THAN OR= TO 20%+20UA

M. TURN OFF 871, AND REMOVE THE DMM AND SET IT TO MEASURE AC VOLTAGE , SWITCH WIRES FROM AMP TO VOLTS.

N. REMOVE THE DMM; REPLACE THE SHORTING BAR; SET "LOWER"SWITCH OFF.

5. PROTECTION MOVEMENT

A. SET RRB TO 220K OHMS

B. TURN ON 871, AND RUN THE TEST.

C. SET THE HV TO 1200V USING THE TEST VOLTAGE CONTROL (8 FIG.1)

D. SET LEAKAGE CURRENT TO 6.0ma (18FIG.1)

E. CHECK PROTECTION MOVEMENT ACCORDING TO TABLE 5-1 FOR MAXIMUM PROTECTION.

RRB	NG LAMP
220K	OFF
180K	ON

TABLE 5-1

F. TURN THE 871 OFF.

G. SET THE LEAKAGE CURRENT TO 60 ma

H. SET THE "LOWER" SWITCH (22 FIG.1) ON.

I. SET RRB TO 180K AND TURN THE 871 ON, RUN TEST.

J. CHECK PROTECTION MOVEMENT ACCORDING TO TABLE 5-2 FOR LOWER PROTECTION.

RRB	NG LAMP
180K	OFF
220K	ON

TABLE 5-2

K. TURN OFF 871, AND SET LOWER SWITCH OFF, SET LEAKAGE CURRENT TO 6ma.

6. CALIBRATION OF INSULATION RESISTANCE METER

FOR A 871 USED ON THE TVLINE USE TABLE 6-2A (AKEI-90274), AND FOR THE ONE USED ON THE VCR LINE OR QA USE TABLE 6-3A (AKEI-90273)

A. SET THE "FUNCTION" SWITCH (13 FIG.1) TO I TEST MANUAL TEST.

B. SET "I TEST VOLTAGE" SWITCH (13 FIG.1) TO 500 V. CHECK 0 BY SHORTING OUTPUT.

C. CONNECT THE RESISTANCE BOX, AKEI-90274, TO THE HV OUTPUT OF THE 871.

D. TURN ON THE 871, AND ADJUST THE LOWER POT TO ZERO AND THE UPPER POT TO ABOUT 200.

E. RUN TEST.

F. SET THE RESISTANCE BOX ACCORDING TO TABLE 6-1 AND OBSERVE RESISTANCE METER READING FOR EACH POSITION, IT MUST BE WITHIN +/- 5%.

RRB1	220K	800K	4.9M	10.9M

TABLE 6-1

F. TURN OFF 871

G. SET "UPPER ON/OFF" SWITCH TO ON.

H. CONNECT THE CORRECT RRB1 BOX TO THE HV OUTPUT.

LIMIT	UPPER	LOWER	LOWER	UPPER
RESISTANCE	11.1M	10.9M	4.9M	5.1M
NG LAMP	ON	OFF	ON	OFF

TABLE 6-2A (TV) 6-2B

LIMIT	UPPER	LOWER	LOWER	UPPER
RESISTANCE	3.4M	3.2M	1.7M	1.9M
NG LAMP	ON	OFF	ON	OFF

TABLE 6-3A (VCR) 6-3B

I. SET THE RRB TO THE UPPER LIMIT (TABLE 6-2A/3A); TURN ON THE 871; RUN THE TEST; SLOWLY ADJUST THE UPPER POT DOWN UNTIL THE NG LAMP COMES ON. SET THE RRB TO THE LOWER LIMIT; RUN THE TEST; NG LAMP SHOULD BE OFF ; IF NOT CONTINUE TO ADJUST THE UPPER POT UNTIL THESE CONDITIONS ARE MET.

J. SET THE "UPPER ON/OFF" SWITCH TO OFF.

K. SET THE RRB TO THE LOWER LIMIT (TABLE 6-2B/3B); TURN ON THE 871; RUN TEST; SLOWLY ADJUST THE LOWER POT UP UNTIL THE NG LAMP COMES ON. SET RRB TO UPPER LIMIT; RUN TEST; NG LAMP SHOULD BE OFF; IF NOT CONTINUE TO ADJUST LOWER POT UNTIL THESE CONDITIONS ARE MET.

L. TURN OFF THE 871.

7. REGULATION:

A. CONNECT THE 149-10A, HIGH VOLTAGE METER TO THE HV OUTPUT.

B. CONNECT THE AKEI-90275 RESISTOR BOX IN PARALLEL TO THE HV METER, AND SET THE RESISTOR BOX TO 2.148 OHMS.

C. SET THE FUNCTION SWITCH TO W TEST MANUAL TEST.

VERIFY THAT THE LEAKAGE CURRENT IS SET TO 6ma.

D. TURN ON THE 871, AND SET TO 1200V; RUN THE TEST

E. CHECK THAT AT EACH RESISTANCE VALUE OF "X" THE 149-10A READS BETWEEM 1080V AND 1296V, AND AT "X" = 159K & 120K OHMS THE PROTECTION LIGHT IS ON. (WHEN MAKING CONNECTIONS ENSURE THE 871 IS OFF!)

(X=2.148M, 1.989M, 1.5M, 1.137M, 858K, 648K, 489K, 369K,279K, 210K)

F. TURN OFF THE 871.

G. REMOVE THE 149-10A.

H. CONNECT THE DIGITAL OSCILLOSCOPE TO THE HV OUTPUT WITH RRB 90275, USING THE SHORTING TERMINALS ON RRB 9027X AND 9027X.

I. OSCILLOSCOPE SET I½-MAIN SWEEP: 20ms, VOLTS/AMP: 5V STORAGE MODEL: SINGLE, AUTO TRIG: OUT, TY: IN

J. SET THE RESISTANCE TO 159K OHMS.

K. TURN ON THE 871.

L. OBSERVE THE PROTECTION TRIP TIME "T" (FIG 7-1) IT MUST BE T $\leq$ 0.5 SEC.

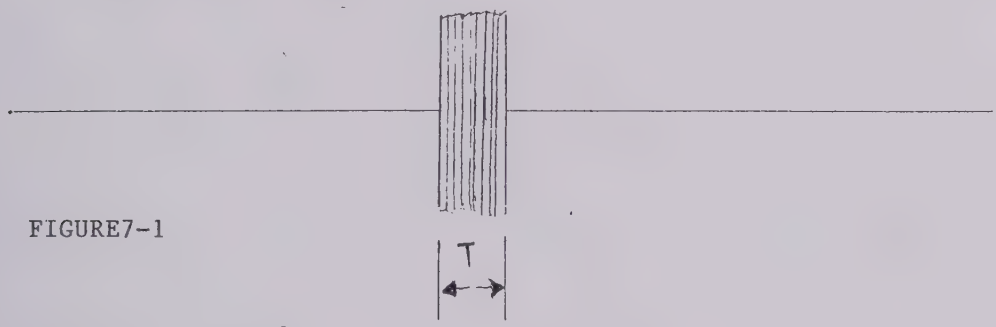


FIGURE7-1

M. TURN OFF THE 871

8. CALIBRATION OF TIMER

A. CONNECT THE DIGITAL OSCILLOSCOPE TO THE HV OUTPUT WITH RRB 90273 OR 90274, USING THE SHORTING TERMINALS ON RRB 9027X AND 9027X.

B. OSCILLOSCOPE SET UP - MAIN SWEEP: .2S, VOLTS/AMP: 5 V STORAGE MODE: SINGLE, AUTO TRIG: OUT, TY: IN

C. SET THE RRB1 TO 220K OHMS, SET THE TIMER TO 1 SEC.

D. TURN ON THE 871.

E. SET THE HV TO 1000V.

F. TURN ON THE TIMER (7 FIG.1).

G. RUN THE TEST.

H. NOTE TIME A & B ON WAVEFORM (FIG. 8-1)

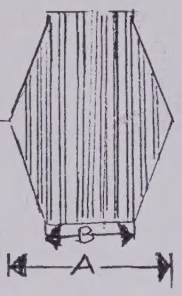


FIGURE 8-1

(A- IS)< = 0.6 sec
(B - IS)< = 0.1 sec

I. TURN THE TIMER OFF.

J. TURN THE 871 OFF AND DISCONNECT ALL THE EQUIPMENT

K. RETURN THE 871 TO ITS PRECALIBRATION OPERATING CONDITION.

L. GET THE ASSISTANCE OF A KNOW HOW USER AND RECONNECT THE 871.

9. AUTO TEST

A. TURN ON THE 871, AND GET A QUALIFIED OPERATER TO HELP WITH THE FOLLOWING.

B. CHECK THAT THE RED TEST LAMP(9 FIG.1) IS ON UNDER THE FOLLOWING CONDITIONS.

1. BY OPERATING THE CHECK TERMINAL, + AND - IN THE AUTO CHECK MODE.

2. BY SHORTING THE CHECK TERMINALS HV AND GROUND IN THE AUTO CHECK MODE.

10. COMPLETION

A. HAVE A QUALIFIED PERSON CHECK THAT THE 871 IS CONNECTED AND OPERATING CORRECTLY THEN HAVE THEM **INITIAL THE SERVICE ORDER.

B. ATTACH THE CALIBRATION STICKER AND FILE SERVICE ORDER AND UPDATE THE COMPUTER FILE CALIBRATIONS.